Dashing Through the Snow

If your quiet walk in the winter woods has ever been disrupted by noise and a whiff of fumes from a snowmobile, you'll understand the impetus behind the SAE Clean Snowmobile Challenge (CSC). The competition tasks college and university students to modify a snowmobile to make it acceptable for use in environmentally sensitive areas, such as National Parks and other pristine regions.

A team of students from Rochester Institute of Technology (RIT) took on the challenge to design, build and race a low-emission, high-efficiency snowmobile. The biggest design challenge is modifying the internal combustion engine to reduce noise and decrease emissions. The RIT team included a custom air-intake system to increase air flow to the engine, a custom exhaust system and muffler to reduce noise, an exhaust gas recirculation (EGR) system to reduce NOx emission, and a turbocharger to improve power output.

The team used ANSYS SpaceClaim to prepare CAD models for simulation with a special-purpose engine design program. Using volume extraction, the student engineers were able to easily generate a flow volume mode.

The RIT Clean Snowmobile Team applied ANSYS Forte software for accurate IC engine combustion performance to design a custom camshaft for the engine. Forte enabled the team to simulate tailpipe emissions during the design stage, before any camshafts were fabricated. The students plan to use the software for further development of their emission control strategy. Although not used in the 2016 snowmobile, the team hopes to integrate custom camshafts along with custom pistons for reducing NOx, HC and CO levels in future engines.

For the 2016 challenge the team made modifications to their chassis to decrease weight. The original suspension, holding a 155-inch track, was replaced with a suspension holding a 144-inch track that was 15 pounds lighter. The suspension modification increased maneuverability and reduced the weight of the snowmobile. However, custom mounting points were needed to accommodate the shorter track. The students used ANSYS Mechanical structural simulation to confirm that the design was safe and in compliance with the SAE CSC rules.

At the 2016 challenge in Michigan, the RIT Clean Snowmobile Team competed in several event categories and won first place in the lab emissions event. The team is already preparing for the 2017 challenge by tearing down the 2016 competition snowmobiles and validating simulations, including models in ANSYS Forte for future use. ∧

Information courtesy Eric Oswald.
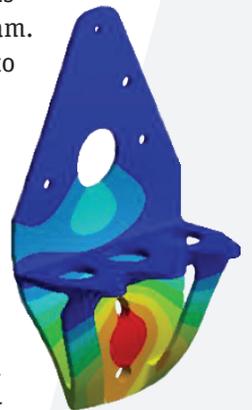
^ Part optimization in ANSYS Mechanical

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